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Feature Article - Accounting for the Environment in the National Accounts

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INTRODUCTION

The economy has a complex relationship with the environment. It provides the raw materials and energy for the production of goods and services that support our lifestyles, but it also sustains damage through the activities of households and businesses. The national accounts are sometimes criticised for including the value of goods and services produced and the income generated through the use of environmental assets, but not reflecting the economic cost of depleting those assets or the damage that arises from economic activity. This anomaly is well recognised by national accountants, as are a number of other deficiencies relating to the use of national accounts as a comprehensive measure of the 'well being' of society (e.g. the value of unpaid housework is excluded from gross domestic product (GDP)).

This article discusses how the environment is currently treated in the national accounts, and gives a broad overview of the work being done by the ABS to extend the core national accounts in what could be called a satellite account for the environment.

INTERNATIONAL STANDARDS

The national accounts are a macro-economic data set revolving around the central economic concepts of production, income, expenditure and wealth. It is also a monetary system, and therefore relies substantially on being able to measure the money transactions taking place between the various economic agents in a market economy. The Australian system of national accounts (ASNA) is based on the latest international standard-**System of National Accounts, 1993** (SNA93).

While the environment clearly provides services to the economy, these are often provided at no cost or are implicit in the value of goods and services rather than in explicit transactions. Environmental assets are often not controlled by economic agents because of their physical nature, or in some cases are so plentiful that they have a zero price. For this reason, the valuation of environmental flows and stocks is fraught with conceptual and practical difficulties. Nevertheless, international research has been proceeding over a number of years and substantial progress has been made in sorting out the issues and concepts, although there is still limited experience in practical measurement.

The United Nations Statistical Division published an interim handbook **Integrated Environmental and Economic Accounting** in 1993. Over the last few years it has been redeveloped and extended by an international expert working group consisting of national

accountants and environmental accountants. The revised handbook, titled **System of Environmental and Economic Accounting** (SEEA), is currently in final draft stage and has recently been endorsed by the United Nations Statistical Conference for publication. It will provide a detailed conceptual and classification framework for environmental accounting and should provide an impetus for the advancement of environmental accounting internationally. Some of the material in the handbook relates to a clarification of the measurement of environmental assets in the traditional system of national accounts, but much of it concerns material that could be developed in a satellite account separate to the traditional accounts. Satellite accounts provide the freedom to develop alternative concepts, classifications and measurement techniques which are different, but at the same time retain a connection back to the national accounts based on SNA93. The environmental accounting work being done by the ABS is consistent with the recommendations in SEEA.

NATURAL RESOURCES IN THE ASNA Stocks

The national and sector balance sheets record the value of environmental assets that are defined as being within the scope of the system of national accounts-known as the asset boundary. For an asset to be included within the asset boundary of the national accounts it must have an identifiable owner, and the owner must be able to derive an economic benefit from the use of the asset. Assets included are those termed economic environmental assets such as subsoil assets, land, forests, water, and fish stocks in open seas that are under the control of an economic agent (often the government).

Environmental assets such as atmospheric and terrestrial ecosystems are outside the scope of economic assets as they do not have an identifiable owner who can derive an economic benefit from their use. This is not to suggest that these assets are of no value. On the contrary, many of them are essential to life itself. However, even if they fell within the definition of an economic asset, the valuation techniques available to measure such assets tend to be arbitrary and controversial.

The environmental assets on the Australian national and sector balance sheets are land, subsoil assets and native standing timber. Land valuations are available through administrative sources, and net present value techniques (which take into account current production rates, prices, costs, and discount rates) are used to value both subsoil and native forest assets. Plantation standing timber could also be considered an environmental asset and plantations are included in the balance sheet as inventories because timber growth is controlled. Water and fish stocks have not been included on the Australian national balance sheet due to a lack of available data.

The Australian national balance sheet recorded $3,459 billion worth of assets as at 30 June 2001, of which $1,160 billion (33%) were economic environmental assets.

AUSTRALIA'S TOTAL ASSETS, Current Prices-as at 30 June 2002

	1993 $b	1994 $b	1995 $b	1996 $b	1997 $b	1998 $b	1999 $b	2000 $b	2001 $b
Financial	145	169	185	193	230	300	316	396	440
Buildings & structures	934	973	1,024	1,067	1,107	1,159	1,236	1,318	1,399
Machinery & equipment	251	257	265	268	274	291	301	312	317
Other produced	96	101	107	104	106	111	118	129	138

Other non-produced	-	-	-	-	-	-	-	3	6
Environmental	631	676	721	736	816	882	966	1,062	1,160
Total assets	2,057	2,176	2,301	2,368	2,533	2,742	2,937	3,221	3,459

- nil or rounded to zero (including null cells)

While land accounts for 84% of the value of Australia's economic environmental assets, the value of rural land accounts for only 12% of the total value of land. Subsoil assets account for 15% and timber (native and plantation) account for 1% of Australia's economic environmental assets. No values are included for water or fish stocks, or other environmental assets outside the SNA asset boundary.

AUSTRALIA'S ENVIRONMENTAL ASSETS, Current Prices-as at 30 June

	1993 $b	**1994** $b	**1995** $b	**1996** $b	**1997** $b	**1998** $b	**1999** $b	**2000** $b	**2001** $b
Rural land	60	65	68	86	91	101	105	110	115
Other land	498	532	557	557	619	669	730	797	861
Oil and gas	38	43	49	49	51	48	51	61	76
Other subsoil	28	28	38	35	46	55	69	83	97
Native standing timber	2	2	2	2	2	2	2	3	3
Plantation standing timber	5	6	6	6	7	8	8	8	8
Total assets	631	676	721	736	816	882	966	1,062	1,160

The value of environmental assets in current prices grew strongly during the 1990's, increasing by 84% between 30 June 1993 and 30 June 2001. Much of this growth was due to rising prices. Environmental assets grew in volume terms by 18% during the same period.

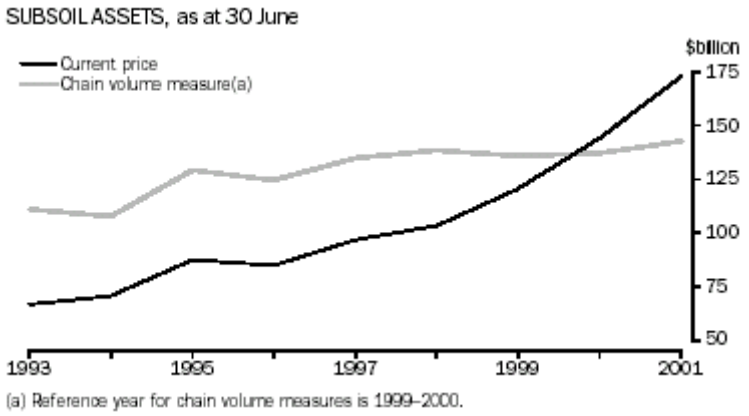
AUSTRALIA'S ENVIRONMENTAL ASSETS, Chain Volume Measures(a) - as at 30 June 2002

	1993 **$b**	**1994** **$b**	**1995** **$b**	**1996** **$b**	**1997** **$b**	**1998** **$b**	**1999** **$b**	**2000** **$b**	**2001** **$b**
Land	781	805	824	805	824	839	860	886	908
Subsoil assets	110	108	129	124	135	139	136	137	143
Native standing timber	3	3	3	3	3	3	2	2	2
Plantation standing timber	6	7	7	7	7	8	8	8	8
Total assets	900	922	963	939	969	988	1,006	1,034	1,061

(a) Reference year for chain volume measures is 1999-2000.

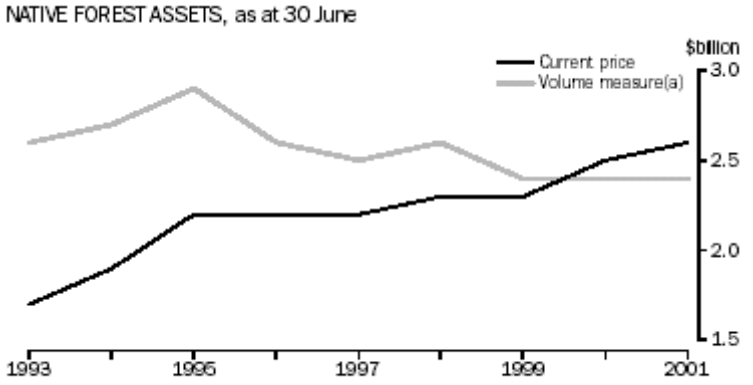
Chain volume estimates of subsoil assets increased by 29% between 30 June 1993 and 30 June 2001, compared with growth of over 160% in current prices. The strong volume growth has been

due to new discoveries exceeding extractions during this period. The current price growth has been driven by increasing prices in significant minerals such as iron ore, magnesite, crude oil, condensate, and LPG, and falling real discount rates. Minerals deposits cannot be extracted all at once, but are extracted over a long time period, and a discount rate is needed to calculate the net present value of future extractions.



(a) Reference year for chain volume measures is 1999–2000.

The volume estimates of native standing timber fell by 8% over the same period, whilst the current price estimates were increasing. Volume estimates have fallen due to logging of native forests and the protection of some forests, resulting in their removal from the economic production boundary of the national accounts.



(a) Reference year for volume measure is 1999–2000.

Whilst the area of land is unlikely to change very much during the normal course of events, volume change also includes changes in quality due to natural processes, soil conservation and other land improvement measures, land degradation due to human activity, and the rezoning of land so that it is available for higher value uses. The practical task of splitting value changes into their price and volume components is a difficult one. As an interim approach, the ABS has calculated the growth in volume of urban land at half the rate of growth in the volume of overlying construction. Zero volume growth is assumed for rural land. This assumes that land degradation, reclassification and land improvement net to zero for rural land.

Transactions-the national income, expenditure and production accounts

The transaction accounts of the ASNA measure production, incomes, consumption, capital and financial flows during the accounting period. GDP is the most readily identifiable statistic from the national accounts. Of most interest in the context of environmental accounting is the way

environmental assets are used in the production process to produce goods and services for consumption, capital investment or export. However, the services provided by the environment are often either implicit in the values for other items or they are excluded as they are costed at zero price.

Where there are explicit rents for the use of natural assets, they are shown in the item 'rent on natural assets' in the sector income accounts. The general government sector received $2.6 billion in resource rents in 2000-01 (mainly from petroleum, mining and forestry royalties). Many environmental assets (e.g. land) are used by their owners for which there is no money transaction.

In terms of GDP, the value of the services provided by the environment are implicit in the value of the output of the products produced and the incomes derived from their sale. In 2000-01, the current price industry gross value added of the agriculture, forestry and fishing industry accounted for 3.5% of total gross value added, whilst the mining industry accounted for 5.2%. The value added also reflects the input of labour and produced capital, as well as natural capital.

The value of new additions to environmental assets such as discoveries of subsoil assets or natural growth in native standing timber are not included as income or GDP. However, the cost of mineral exploration is regarded as fixed capital formation, and is reflected in GDP as the creation of an asset.

As mentioned, no deduction is made from income for the depletion or degradation of the natural environment. Thus:

> '...a country could exhaust its mineral resources, cut down its forests, erode its soil, pollute its aquifers, and hunt its wildlife to extinction, but measured income would not be affected as these assets disappeared' (Repetto et al, 1989).

A SATELLITE ACCOUNT FOR THE ENVIRONMENT

The national accounts have a wide range of potential uses for policy making and economic and social research, and thus it is unlikely that the core accounts will be able to meet all possible objectives. In recognition of this, satellite accounts allow for a more flexible approach by providing frameworks that are linked to the national accounts, but focusing on a certain aspect of social or economic life. Satellite accounts also allow for standard concepts to be varied to suit particular studies within the context of the national accounts.

An environmental satellite account could take a number of forms and have a number of layers of detail. The ABS work program has focussed on compiling asset accounts and accounts which decompose the changes in the value of assets during a period. The latter accounts can be used for adjusting the national accounts for the depletion of and additions to specific environmental assets in a satellite account framework.

Measuring depletion

Depletion is defined in the SNA93 as the

> '...reduction in the value of deposits of subsoil assets as a result of the physical removal and using up of the assets, ... the depletion of water resources, and the depletion of natural forests, fish stocks in the open seas and other non-cultivated biological resources as a result of harvesting, forest clearance, or other use.' (SNA93, 12.29 and 12.30).

Depletion in an economic sense results because the value of the resource stock has been lowered through its use in a productive activity, and the use has reduced the asset's ability to produce an income stream in the future. In this sense depletion is analogous to depreciation of produced assets whereby the current value of the stock of fixed assets declines from normal use.

Physical depletion may not necessarily equate to economic depletion in cases where asset values are low or the resource life is long. While the physical dimension of depletion can be fairly readily observed in practice, its value cannot. This is because the mineral or other natural resource product is not what is being valued-rather it is the decline in the value of the mineral asset below the ground or of the standing timber in the forest. Generally, one has to resort to capital theory to undertake this valuation. In capital theory the value of depletion is a derivative of the amount of the resource extracted and the resource rent.

The resource rent is the value of the flow of capital services provided by a natural asset. It is calculated as the value of the output of the natural resource production (e.g. coal, oil) after the intermediate expenses, returns to labour (wages), returns to produced capital (profits accruing from the use of produced capital), and returns to government (taxes) have been removed. Algebraically, the resource rent is represented as:

$$RR = (p - c) * Q$$

where

RR = resource rent,
p = unit price,
c = unit cost (includes wages, intermediate costs, normal return to produced capital, and taxes), and
Q = quantity extracted

The resource rent in each period is discounted to derive the net present value (NPV) of the natural asset:

$$V_t = \sum_{t=1}^{n} \frac{RR}{(1+r)^n}$$

where

V = NPV,
r = discount rate, and
n = asset life

Depletion can be shown to be equal to the resource rent in the year minus a return (income) on the natural resource asset.

$$d_t = V_{t-1} - V_t = RR_t - rV_t$$

where

d = depletion

Where the total stocks of an asset are unknown, discoveries of new stocks of subsoil assets or growth in biological assets may increase the stock of a resource so that the level of currently exploitable reserves from which the economic valuation is derived is rising rather than falling. How to account for additions is a vexed issue. In the national accounts, the value of mineral exploration is included as a separate produced asset and is therefore in income and GDP. It

could be argued that this should be replaced with the actual value of discoveries.

The following sections focus on subsoil, land and forest assets respectively.

Subsoil assets

Subsoil assets are considered to be economic when they have a high geological assurance, extraction is expected to be profitable at the prevailing price and technology, and when they are owned by an economic entity (usually the government). In the Australian balance sheets economic demonstrated resources (EDR) include both proven and probable reserves.

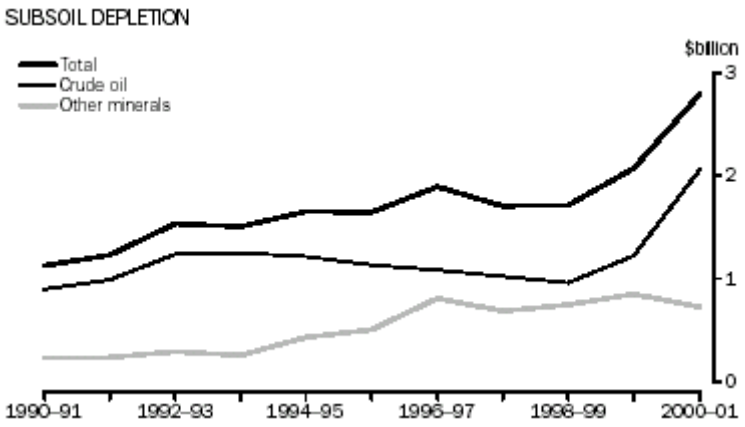
Although SNA93 recommends that assets should be valued at their current market price, for many natural assets it is not possible to observe the market price directly as there is little trading of undeveloped stocks in the marketplace. The next best method is to value assets as the net present value (NPV) of the future expected earnings which is theoretically equivalent to the market value. This is the approach that has been adopted in the national balance sheet and in deriving estimates of the value of depletion and additions to subsoil assets presented below.

Year-to-year changes in the value of subsoil assets for Australia can be decomposed into revaluations, depletion and discoveries. Revaluations capture the change in prices of the existing stock.

RECONCILIATION OF OPENING AND CLOSING VALUES FOR SUBSOIL ASSETS, Current Prices

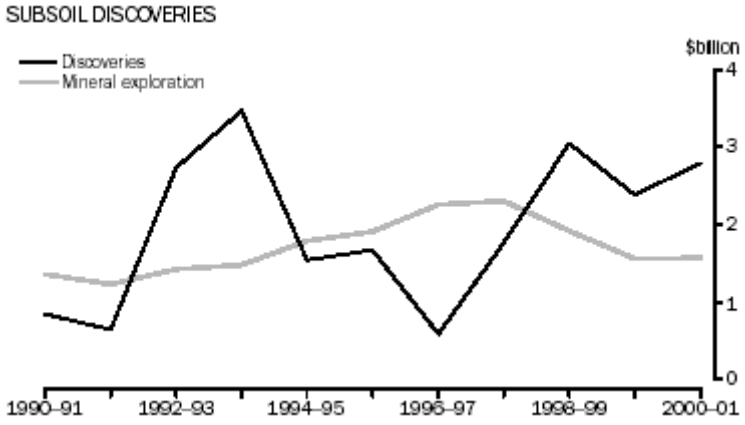
	Opening stock $m	Revaluation $m	VOLUME CHANGES		Closing stock $m
			Depletion $m	Discoveries $m	
1990-91	52,020	4,653	-1,126	841	56,388
1991-92	56,388	-27	-1,228	634	55,768
1992-93	55,768	9,586	-1,531	2,737	66,559
1993-94	66,559	1,946	-1,509	3,470	70,466
1994-95	70,466	17,185	-1,650	1,542	87,543
1995-96	87,543	-2,846	-1,640	1,664	84,721
1996-97	84,721	13,332	-1,892	583	96,743
1997-98	96,743	6,558	-1,703	1,762	103,361
1998-99	103,361	15,716	-1,710	3,050	120,416
1999-00	120,416	23,203	-2,073	2,383	143,929
2000-01	143,929	28,944	-2,785	2,785	172,873

The depletion in any one year is the change in the value of the asset between the beginning and end of the year arising purely from the extraction of minerals. As can be seen from the chart below, the depletion of crude oil accounts for a high proportion of the total depletion estimate. This is a reflection of crude oil's relative scarcity and high value.

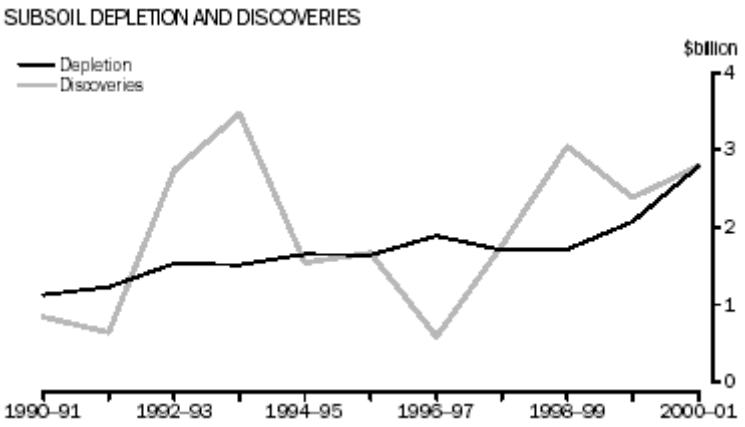


A discovery occurs when previously unknown stocks of minerals are found and delineated. It is valued using the same NPV techniques described earlier. In the national accounts the value of a new discovery in itself is not considered as production or income because it is a gift of nature. However, the cost of mineral exploration is considered as production and included in income and GDP.

One approach that could be considered in a satellite account is to include the value of a discovery as production and income and to treat the exploration cost as intermediate input to the production of discoveries. As shown in the chart, the value of discoveries shows an erratic pattern which under such an approach would flow through to income. A possible variation on the concept could be to record the value of discoveries as an accrual over the average period of exploration in order to smooth the income flow.



As long as the value of discoveries continues to outpace or equal the value of depletion the activity can be seen to be sustainable.



Land/soil assets

Where land is used sustainably, it has an infinite life and therefore no adjustment for depletion is required-the whole value of the resource rent would rightly be considered as income. However, where land is being degraded due to economic activity, an adjustment to income for land degradation is applicable. As for subsoil assets discussed above, any economic costs should be offset against the benefits (income) derived from agricultural land use.

In the context of economic depletion used here, land degradation represents the year-to-year decline in the capital value of land resulting from economic activity (after deducting price rises due to inflation). Looked at another way it is equivalent to the year-to-year change in the net present value of the lost resource rent resulting from the declining productive capacity of the land. As such, it stops well short of a full measure of the cost of land degradation such as the cost to environmental systems and public infrastructure. The latter would, however, be captured in the national accounts estimates for consumption of fixed capital.

Changes in the value of agricultural land can be ascertained from data on market values or land rates data. However, data for land values are affected by a host of factors other than changes in productive capacity from the impact of land degradation, including inflation, technological advances and changes in land use due to re-zoning, subdivision and 'lifestyle' considerations (Roberts, B., 1997).

Two recent national studies used different approaches to measuring economic losses due to land degradation.

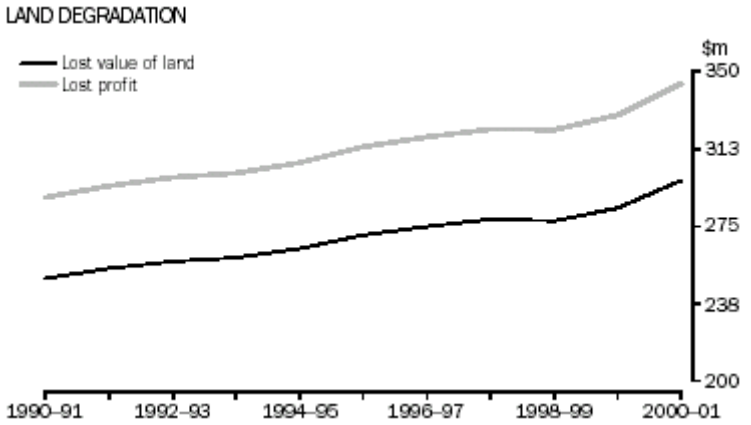
- ABARE (2001) used a farm survey to ascertain the extent of land degradation on farms. Combining data from the survey with land value data, regression techniques were used to estimate that the difference in the capital value of farms with and without degradation was approximately $14.2 billion in 1999. This represents the accumulated value of losses in land value due to degradation.

- The National Land and Water Resources Audit (2002) used models to estimate the 'yield gap' i.e. the difference between profits with and without soil degradation. Lost profit at full equity due to salinity, sodicity and acidity was estimated as $2.6 billion in 1996-97.

To compare the results, either the former estimate has to be converted to a lost profit stream or the latter has to be capitalised. Profit at full equity is a measure of the net returns to land and water resources used for agriculture, and the managerial skill of land managers. Adjusting this concept to resource rent by removing the returns to the manager's labour and produced capital,

and using a real discount rate of 5.8%, the capitalised value of the lost resource rent due to all past degredation is $16.4 billion in 1996-97. The results using this method are sensitive to the discount rate. The real discount rate has been derived as the long term government bond rate adjusted by the CPI in 1996-97.

Whilst the estimates mentioned above represent the accumulated value of losses in land value due to all past degradation since European settlement, it is the year-to-year increment in the value of degradation that should be deducted from farm income in each period (consistent with the treatment of depreciation of produced assets). There are a number of issues to consider, including whether to deduct degradation from income in the periods when the effect becomes evident, or in the periods in which it was caused (sometimes decades or even a century earlier). The latter would seem appropriate in economic accounting. For the purpose of the indicative estimates contained in this article, it has been assumed that degradation accumulated evenly over a period of fifty years. Using the $14.2 billion figure for lost land value, the annual increment (in 1999 dollar terms) is $284 million per year. Using the alternative estimate of $16.4 billion, degradation is $329 million per year (in 1997 dollar terms). The annual los
ses are adjusted using the chain price index for GDP to arrive at degradation in current prices. The higher value has been taken into the summary estimates provided in a later table. For estimates post 1999 it has been assumed that degradation will accrue at the same rate. No adjustments have been made to account for land improvements that might reduce the future loss of resource rent.



Forest assets

Forests are renewable biological resources. There are two types of forest: old growth native forests (95% of the area of all Australian forests) and plantations. Broadleaved and coniferous plantation standing timber are treated as produced assets in the national accounts, as the growth is under the direct control, responsibility and management of the owner. They are classified as inventories. Native forests are treated as non-produced assets, as although they may be owned and available for use, their growth is not the result of an economic process. As for other non-produced assets, the depletion of native forest assets due to harvesting is not charged against income in the national accounts.

The valuation of the depletion of renewable assets presents a different set of issues to non-renewable assets as it may be possible to replace (over time) the part of the asset that is used in the current period. Where a forest is harvested sustainably, no depletion adjustment is required. SEEA suggests that either depletion and additions can be calculated separately, or that just the net depletion could be calculated. Where old growth will not be replaced, only a depletion adjustment will apply. In some areas however, old growth forest will become second growth forest. Where extractions (i.e. timber harvesting) still exceed growth, depletion should exceed

additions. Once the transition period from old growth forest to second growth forest is complete, growth may exceed harvest. In this case yield can be considered economically sustainable.

In principle, the best approach would be to calculate both depletion and addition adjustments as this allows for the two impacts to be explicitly identified. Depletion is calculated as the change in the NPV of the forest arising from the harvesting of timber (similar to subsoil assets). The value of additions is the NPV of the growth in any one year. The compilation of this series requires data on the annual increase in forest cover.

It is also possible that forests will come into or out of scope of the balance sheet due to land use management decisions or catastrophic events (e.g. bushfires) that affect the volumes of standing timber. Such changes should not be recorded as depletion because they are not regular economic events. Rather, they should be included as either positive or negative additions to assets in the balance sheet and recorded in the 'other change in assets account'.

Estimates are not yet available for depletion of native forests. However, given the value of native forests on the national balance sheet is $2.6 billion compared with $172.9 billion for subsoil assets, it is expected that depletion of the former will be relatively insignificant. This of course is taking an economic view only and does not account for damage to intrinsic non-monetary values such as ecosystem services, biodiversity and aesthetic/recreational values.

Adjusting the national accounts

It was stated earlier in this article that there is an asymmetry in the national accounts between the treatment of produced assets such as buildings, and plant and natural (non-produced) assets. Depreciation of produced assets (termed consumption of fixed capital in the national accounts (COFC)) is deducted to derive the various 'net' income measures in the national accounts such as net domestic product (NDP), net operating surplus (NOS), net national income and net saving. No such deduction is made for natural assets when they are used up or degraded as a result of economic activity. The net measures thus fall short of being sustainable concepts of income, although they are superior to the various 'gross' measures in the national accounts in this respect.

The experimental estimates derived for the value of depletions and discoveries of subsoil assets and the degradation of agricultural land are indicative of adjustments that could be made to the national accounts in the context of a satellite account and are illustrated in the following table. Depletion adjustments unambiguously lower the net values. If the value of discoveries is included in income in place of the value of mineral exploration, the net effect of that adjustment can be positive or negative.

PRODUCTION AND CAPITAL INCOMES ADJUSTED FOR DEPLETION AND ADDITIONS, Australia-Current Prices

	1992-93 $m	1993-94 $m	1994-95 $m	1995-96 $m	1996-97 $m	1997-98 $m	1998-99 $m	1999-00 $m	2000-01 $m
+ SUBSOIL DEPLETION	1,531	1,509	1,650	1,640	1,892	1,703	1,710	2,073	2,785
+ LAND DEGRADATION	299	301	306	313	318	322.0	322	329	344
- Subsoil additions	2,737	3,470	1,542	1,664	583	1,762	3,050	2,383	2,785
+ COST OF MINERAL EXPLORATION	1,418	1,471	1,791	1,905	2,257	2,300	1,916	1,562	1,563

- COFC on mineral exploration	1,086	1,109	1,147	1,199	1,248	1,316	1,364	1,448	1,517
+ NET DEPLETION ADJUSTMENT	**-575**	**-1,298**	**1,058**	**995**	**2,636**	**1,247**	**-466**	**133**	**390**
GDP	425,706	446,480	471,348	502,828	529,886	561,229	591,592	629,212	670,029
- Consumption of fixed capital	69,775	73,773	76,264	78,617	80,376	86,160	91,316	97,663	104,292
+NDP	355,931	372,707	395,084	424,211	449,510	475,069	500,276	531,549	565,737
- Net depletion adjustment	-575	-1,298	1,058	995	2,636	1,247	-466	133	390
+ DEPLETION ADJUSTED NDP	**356,506**	**374,005**	**394,026**	**423,216**	**446,874**	**473,822**	**500,742**	**531,416**	**565,347**
GOS and GMI	177,512	185,849	192,149	202,687	210,158	227,762	234,776	253,803	264,641
- Consumption of fixed capital	69,775	73,773	76,264	78,617	80,376	86,160	91,316	97,663	104,292
+ NOS	107,737	112,076	115,885	124,070	129,782	141,602	143,460	156,140	160,349
- Net depletion adjustment	-575	-1,298	1,058	995	2,636	1,247	-466	133	390
+ DEPLETION ADJUSTED NOS	**108,312**	**113,374**	**114,827**	**123,075**	**127,146**	**140,355**	**143,926**	**156,007**	**159,959**
Net saving	3,631	9,238	6,038	10,717	19,600	20,567	18,173	19,672	18,508
- Net depletion adjustment	-575	-1,298	1,058	995	2,636	1,247	-466	133	390
Depletion adjusted saving	**4,206**	**10,536**	**4,980**	**9,722**	**16,964**	**19,320**	**18,639**	**19,539**	**18,118**

The net saving levels are changed by the same amount as for NOS, but the nation's net lending position is left unchanged.

Adjusting the national accounts for depletion and additions of subsoil assets also affects growth rates, which may increase or decrease. As the table below shows, the adjustments have the biggest impact on both NDP and NOS in 1994-95, due to the low value of subsoil asset additions in that year compared to the previous one.

PRODUCTION AND CAPITAL INCOMES ADJUSTED FOR DEPLETION AND ADDITIONS, Australia-Current Prices: Percentage Changes

	1993-94 %	**1994-95 %**	**1995-96 %**	**1996-97 %**	**1997-98 %**	**1998-99 %**	**1999-00 %**	**2000-01 %**
GDP	4.9	5.6	6.7	5.4	5.9	5.4	6.4	6.5
NDP	4.7	6.0	7.4	6.0	5.7	5.3	6.3	6.4
Depletion adjusted NDP	4.9	5.4	7.4	5.6	6.0	5.7	6.1	6.4
Net change in NDP growth	**0.2**	**-0.7**	**-**	**-0.4**	**0.3**	**0.4**	**-0.1**	**-**
GOS and GMI	4.7	3.4	5.5	3.7	8.4	3.1	8.1	4.3
NOS	4.0	3.4	7.1	4.6	9.1	1.3	8.8	2.7
Depletion adjusted NOS	4.7	1.3	7.2	3.3	10.4	2.5	8.4	2.5
Net change in NOS growth	**0.6**	**-2.1**	**0.1**	**-1.3**	**1.3**	**1.2**	**-0.4**	**-0.2**

- nil or rounded to zero (including null cells)

Energy and greenhouse gas emissions

A satellite account for energy and greenhouse gas emissions using the input-output framework was published by the ABS in **Energy and Greenhouse Gas Emissions Accounts** (Cat. no. 4604.0) in 2001. It presented information on the supply, use and stock of primary energy resources, supply and use of secondary energy products, and greenhouse gas emissions associated with the use of these energy resources. Energy use and emissions of greenhouse gases were linked with economic data and tracked through the economy so that emissions were allocated to final end users of products, rather than the producers of products.

Of the total net energy supply (13 397 PJ), 66% was exported, 7% was consumed by households and 18% consumed by industry. Together household electricity use and motor vehicle use by households accounted for over 30% of Australia's energy related greenhouse gas emissions.

FUTURE WORK AND FURTHER INFORMATION

The work program on environmental satellite accounting is continuing. The ABS hopes to extend the depletion adjustment to include native forests. Other areas of work will be to highlight environmental protection expenditures and to look at extending the economic asset boundary to include the value of water and possibly fish. Work on the valuation of environmental damage (externalities associated with human and economic activity) is an undeveloped field of research and it is unlikely that the ABS will have the capacity to make advances in this area in the foreseeable future.

The ABS welcomes comments on environmental satellite accounts and measuring the depletion of Australia's natural resources. These can be directed to Luisa Ryan on Canberra 02 6252 7346 or e-mail <luisa.ryan@abs.gov.au>.

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